

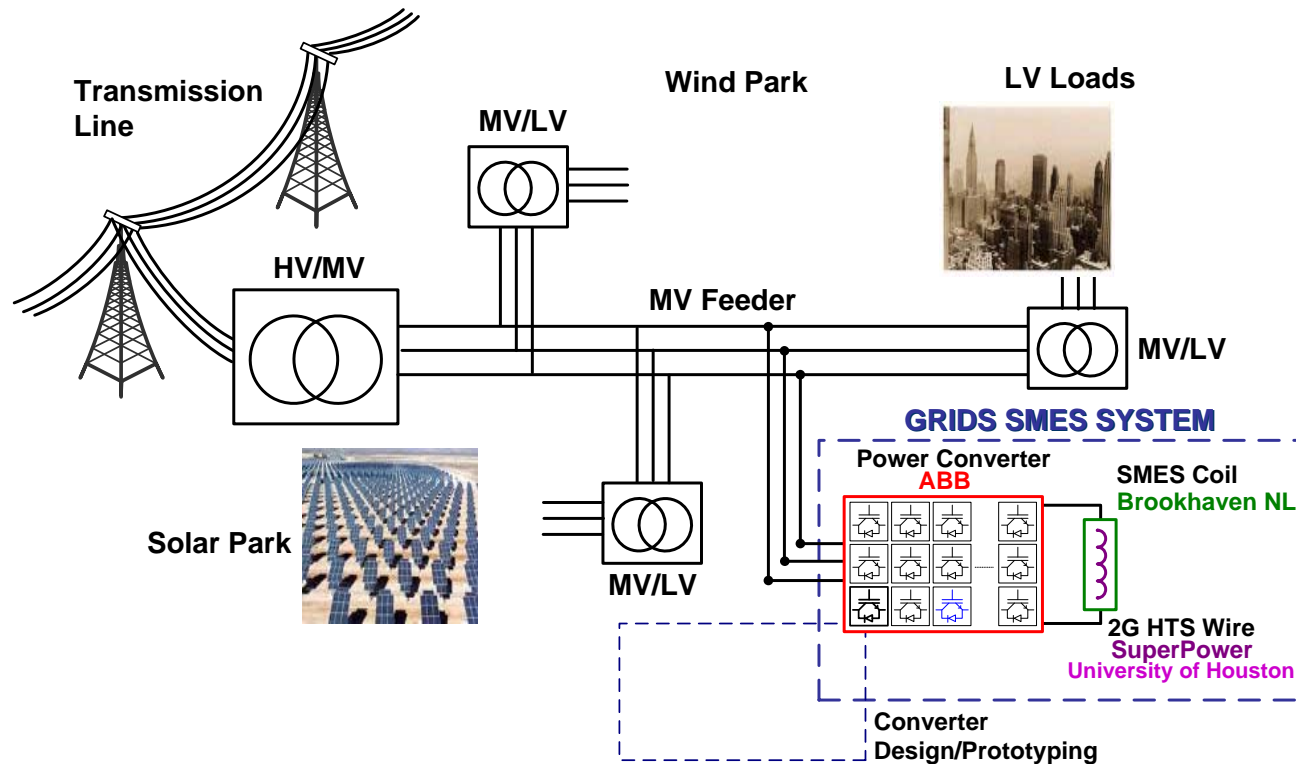
Superconducting Magnet Energy Storage System with Direct Power Electronics Interface

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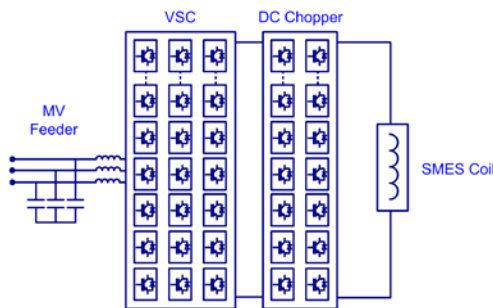
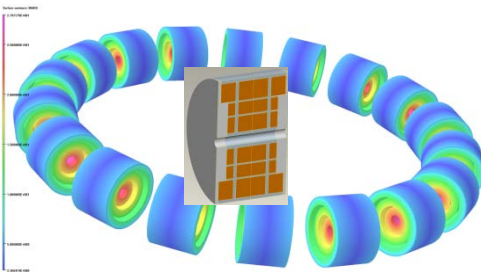
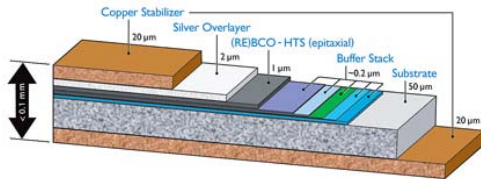


Overview

- Energy is stored in the magnetic field (B) of a superconducting magnet; amount of stored energy scales as B^2
- Project Goal: A competitive, fast response, grid-scale MWh superconducting magnet energy storage (SMES) system



Main Deliverables



- Wire:
 - Second generation high-temperature superconducting (2G HTS) wire with ≥ 600 A critical current
- Magnet:
 - Ultra-high field (≈ 25 T at 4.2 K) magnet storage coil, support structure, and quench protection
- Converter:
 - Modular, scalable direct medium voltage (MV) grid connection concept
 - Demonstration at low voltage, power
- System
 - 20 kW, 2.5 MJ SMES demonstrator with high round trip efficiency ($> 85\%$)
- Commercialization plan
 - Including HTS cost reduction plan

Clear Advantages

A SMES system offers distinct advantages over other storage systems

- Energy storage and dynamic compensation capabilities
 - Fast dynamic response and nearly infinite cycling capability of the superconducting magnet coil
- No moving parts or reacting chemicals
 - Solid state operation; Very long lifetimes and environmentally benign
- SMES system costs expected to be comparable to that of lead-acid battery storage systems

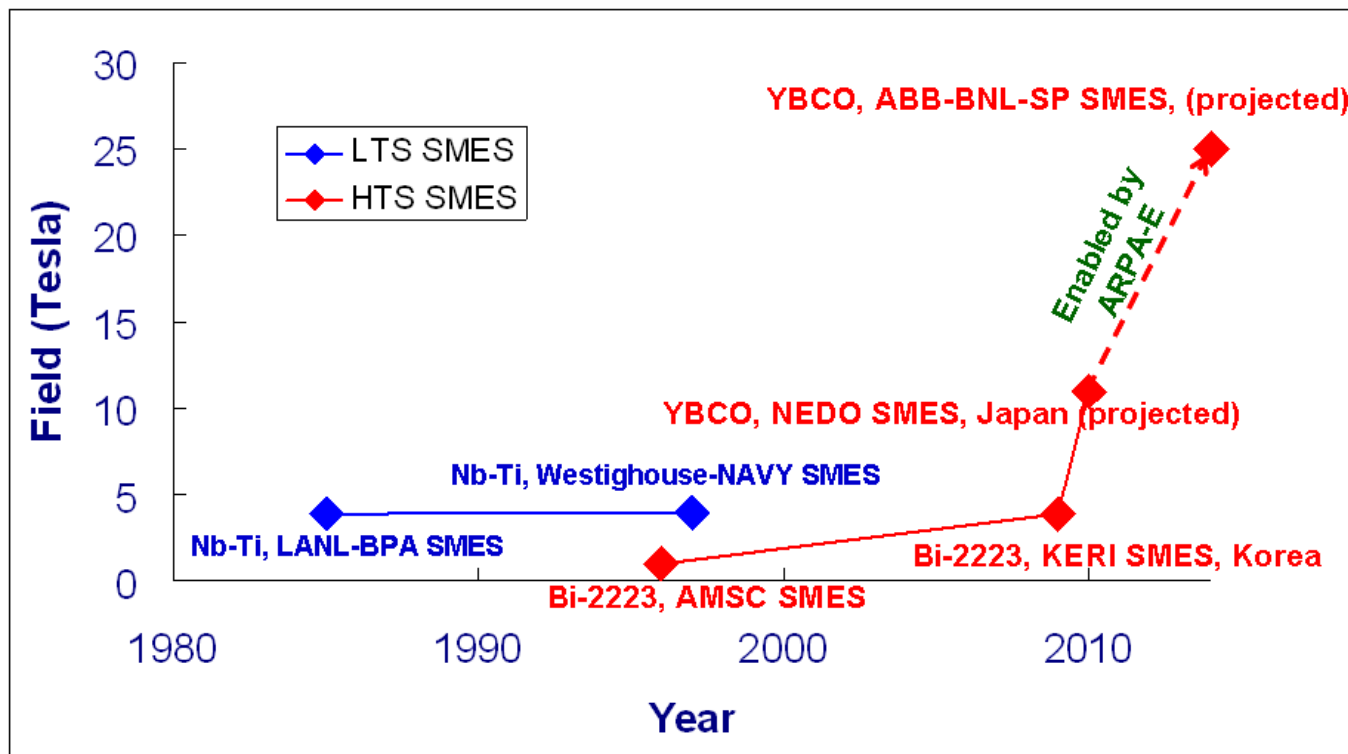
Challenges



Representatives from Project Team
Organizations BNL, SP, ARPA-E,
ABB, and UH

- Aggressive plans to propel the performance of each of the individual subsystems far beyond the state-of-the-art
 - 2G HTS wire with highest critical currents used to produce ultra-high field magnet coil
 - A modular, scalable power converter structure with high blocking voltages, along with advanced modulation and control techniques to allow direct, transformer-less connection to MV distribution feeders
- Risk mitigation plans are in place

Aggressive Targets



Success in this technology enablement project will facilitate the development of a blueprint for the deployment of cost efficient SMES systems for energy storage